Microwave Sample Preparation Standard Laboratory Module (SLM™)

General Overview of the Microwave Sample Preparation SLM

The Microwave Sample Preparation SLM automates the sample conditioning steps necessary for processing by the Microwave Digestion SLM.

Environmental Protection Agency (EPA) Method

The Sample Preparation SLM is the first SLM required for automated implementation of US-EPA Method 3051, "Microwave Assisted Acid Digestion Of Sediments, Sludges, Soils, And Oils."

Standard Analysis Method (SAM)

This SLM supports SAM systems requiring an acid digestion/extraction of metals from the matrix by reacting the sample with acid at high temperature and pressure within the microwave digestion vessel.

Advantages

This SLM works in the overall scheme of the system to reduce the exposure of the analysts to potentially harmful chemicals and fumes. It also provides the task sequence controller (TSC) with verification of the operations performed for the chain-of-custody document generated for each sample processed through the system. Additional advantages of the Sample Preparation SLM are reduced labor costs and improved accuracy and repeatability provided by the automated system.

General Description of the Microwave Sample Preparation SLM

Initial loading of the sample into the Microwave Sample Preparation SLM digestion vessel is performed by an analyst. It includes weighing and logging the sample into the system with a traceable bar-code number. The vessel is loaded into a rack and placed in the input queue for the SAM.

Figure 1. The Microwave Sample Preparation SLM.

Figure 2. The digestion vessel.

Robotics Technology Development Program

The Sample Preparation SLM accepts the preloaded vessel and performs the following sequence of operations. First the vessel is clamped in a set of lower jaws; then a set of upper jaws clamps and unscrews the lid. The lid is raised, opening the vessel. A dispensing arm places a dispensing tip over the open vessel, and the appropriate volume of acid is dispensed into the vessel. When the dispensing arm has rotated out of the dispensing position, the lid is lowered onto the vessel, screwed down, and torqued to the proper value. The vessel is then released, and a message is sent to the TSC indicating the process is complete. The TSC signals the robot to pick up the vessel and move it to the next SLM.

The operation of the Sample Preparation SLM is controlled by an embedded controller. Raising and lowering actuations and clamping are performed by pneumatics. Rotation is done by an electric motor. The motor current is monitored for the correct torque indication. Acids for the digestion of the sample are metered with syringe pumps. Communication with the TSC is provided by a serial port on the instrument.
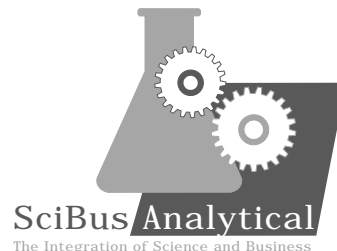
Status

The Sample Preparation SLM is in the prototype stage of development. Validation has not been completed.

Industrial Partner

SciBus Analytical, Inc.

Developers

The Department of Energy laboratory responsible for the Sample Preparation SLM development is Pacific Northwest Laboratories.

University of Florida
University of Tennessee
University of Texas

Los Alamos
NATIONAL LABORATORY

Los Alamos, New Mexico 87545

A U.S. DEPARTMENT OF ENERGY LABORATORY